



JPL Outdoor LASER Safety Plan

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Presented by

FRED BATTLE

Office of Safety and Mission Success

DSN SYSTEM SAFETY

Jet Propulsion Laboratory



JPL Outdoor LASER Safety Plan

- Safe Laser Beam Propagation Requirements:
 1. Safety of personnel.
 - OSHA / ANSI Z136.1 & Z136.6
 2. Propagation through the atmosphere and beyond requires:
 - FAA approval for the “use” of the Navigable Air Space (NAS)
 - Laser Clearing House (LCH) approval (USAF Space Command)



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- History of Laser Beam Propagation at JPL/Table Mountain Facility (TMF)
 - JPL Optical Communications Group has a clear record of safe atmospheric laser beam propagation.
 - From the late 1980's, the optical communication engineers have taken a proactive approach working with laser beam propagation experiments.
 - JPL has established an excellent working relationship with the FAA.



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- Historical FAA/JPL Coordination
 - 1992 Galileo Optical Experiment (GOPEX) Demonstration
 - JPL worked with FAA to define guidelines for safe atmospheric laser beam propagation.
 - FAA required an outside observer.
 - 1995 GOLD Demonstration
 - Satellite tracking scenarios
 - FAA required outside observer and radar system integrated to the telescope.



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DSN Defined Safety Tiers/Levels of Detection

- Tier-1

0(Sea Level) – 11,000 ft (JPL developed technology)

* LWIR is an Aircraft Avoidance Detection System that captures low flying and fast moving aircraft that would not be detected by FAA radar. Currently operates w/Outside Observer.

Tier-2

0(Sea Level) – 60,000 feet (FAA airspace) Bore sighted radar w/telescope.

- Tier-3

Above 60,000 feet (USAF)

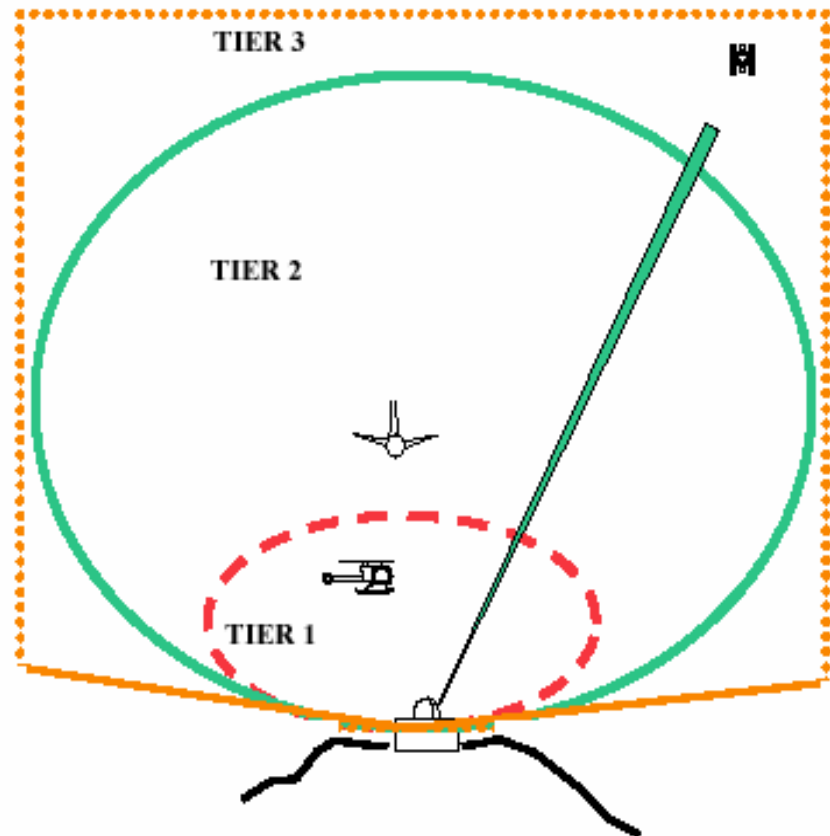
- “Black” and high altitude projects
- Spacecraft (USAF Space Command)
- Downloaded orbital tracks w/inhibit areas noted



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JPL's future goal of unattended ground to space optical communication

- **Defined three safety tiers for autonomous unattended ground station operation**
 - Additional tier (0) addresses OSHA requirements
 - Applies during initial station start up and maintenance operations





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Tier-1 LWIR Sensor – Developed by JPL and ILI

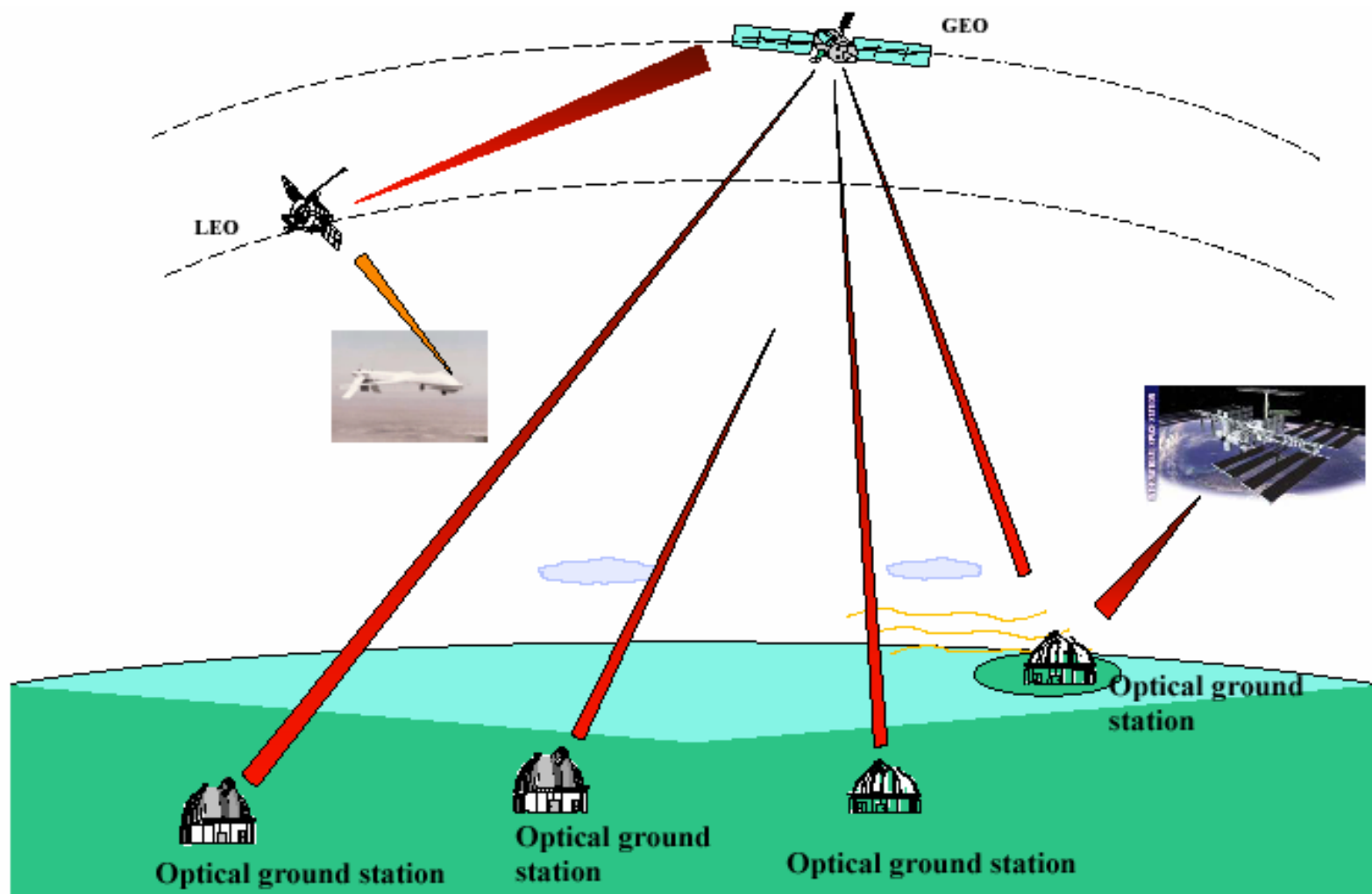




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VISION





JPL Outdoor LASER Safety Plan

- JPL's Goals and Challenge
 1. JPL to be a center of excellence for safe laser beam propagation.
 - Developed a formal written Ground-based Laser Beam Propagation Program.
 - Peer review of all JPL outdoor operations by the JPL Laser Safety Committee. JPL Outdoor Laser Safety Officer appointed.
 - Follow the three tiers of safe outdoor laser beam propagation.
 2. To integrate new technology being developed at JPL, into future projects to ensure safe laser beam propagation.
 3. To provide this technology to other NASA centers for their ground-based laser program.
 4. JPL's future goal to utilize unattended, remote ground to space optical uplinks.



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- OCTL has operated since “first light” November 7, 2005, without incident.
- OCTL has logged over 100 hrs. of laser beam propagation/tracks to more than 20 satellites and celestial objects.
- OCTL safety systems (Tier-0 thru 3) operate to be “fail safe” upon loss of power by shuttering the beam path. Any “no” vote shutter beam path.



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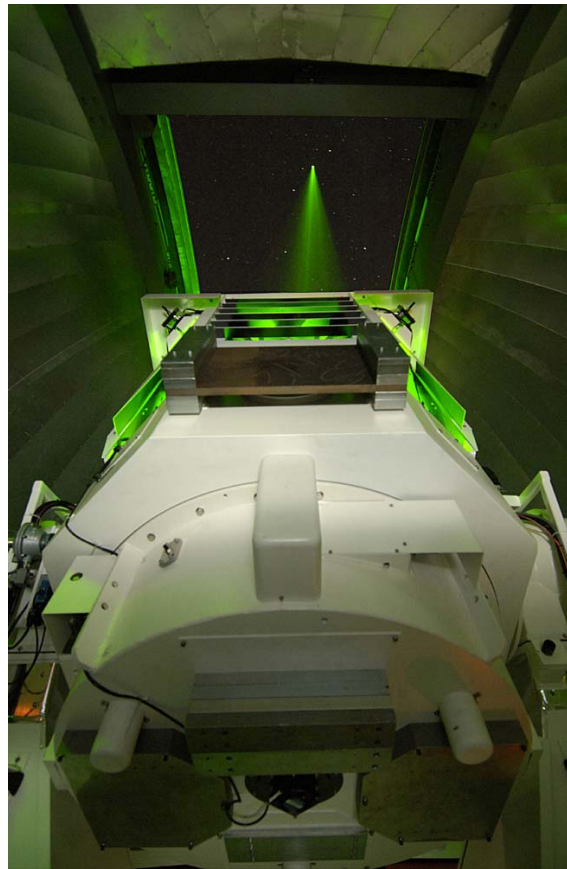


JPL Outdoor LASER Safety Plan

- Summary
 - JPL is dedicated to providing technology to advance the safety of our projects and operations.
 - JPL's objective is to assist NASA in developing an Outdoor LASER Safety Program w/cost effective hardware that is potentially operable and transportable to other sites.
 - JPL is determined to integrate and advance technology to meet the needs of regulatory agencies as well as the NASA mission.



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- Acknowledgments
 - Dr. Keith Wilson - OCTL Manager